

7. SAMPLING DISTRIBUTIONS

Introduction	178
Effect of Population Parameters on a Sampling Distribution	181
Effect of Sample Size on a Sampling Distribution	182
Distributions of Sample Means	185
The central limit theorem	187
Distributions of Sample Proportions	192
Sampling Distribution of Number of Occurrences	193
Sampling from a Finite Population	194
Summary	197

8. ESTIMATION

Introduction	201
Point and Interval Estimates	202
The Rationale of Estimation	203
Estimating the Mean of a Population	205
Population standard deviation known	205
Estimation error	206
Sample size determination	208
Estimating means when σ_x is unknown: The t distribution	209
Sampling from small populations: The finite correction factor	213
One-sided confidence intervals	214
Estimating the Proportion in a Population	216
Confidence intervals: the formula approach	217
Error	218
Sample size determination	219
Sampling from finite populations	220
Confidence intervals: The graphical method	221
Summary	224

9. SIGNIFICANCE TESTING

Introduction	230
Chance Variation or Real Variation?	231
One-sided Tests and Two-sided Tests	234
Type I and Type II Errors	237
Summary	238

10. SIGNIFICANCE TESTS OF MEANS

Introduction	242
One-Sample Test of Means	243
σ_x Known	244
σ_x Unknown	246

BUSINESS STATISTICS

April 2

BUSINESS STATISTICS

Concepts and Applications

William J. Stevenson

Rochester Institute of Technology

Harper & Row, Publishers
New York Hagerstown San Francisco London

311.2
584.5
-p3

Sponsoring Editor: Charlie Dresser
Project Editor: Eleanor Castellano
Designer: T. R. Funderburk
Production Supervisor: Marion Palen
Compositor: Syntax International Pte. Ltd.
Printer and Binder: Halliday Lithograph Corporation
Art Studio: Vantage Art, Inc.

BUSINESS STATISTICS: Concepts and Applications
Copyright © 1978 by William J. Stevenson

All rights reserved. Printed in the United States of America. No part of this book may be used or reproduced in any manner whatsoever without written permission except in the case of brief quotations embodied in critical articles and reviews. For information address Harper & Row, Publishers, Inc., 10 East 53rd Street, New York, N.Y. 10022.

Library of Congress Cataloging in Publication Data

Stevenson, William J
Business statistics.

Includes index.

1. Statistics. I. Title.

HA29.S798 519.5 77-16120
ISBN 0-06-046445-3

This Book Is Dedicated to You

SEP 18 '78

HUNT LIBRARY
CARNEGIE-MELLON UNIVERSITY
PITTSBURGH, PENNSYLVANIA 15213

contents

Note to the Student	xv
Preface	xvii

1. INTRODUCTION

What Is Statistics?	3
Why Study Statistics?	5
The Use of Models in Statistics	5
Looking Ahead	7
Summary	8

2. ORGANIZING, SUMMARIZING, AND PRESENTING STATISTICAL DATA

Introduction	13
Data versus information	13
Statistical Data	14
Types of data	14
Sigma Notation	16
Analysis of Small Data Sets	20
Measures of Center	21
The mean	21
The weighted mean	23
The median	23
Comparison of the mean and the median	24
The mode	25
Measures of Dispersion	26
The range	27
Measures of dispersion that use the mean as a reference point	28
Mean absolute deviation	28
The variance	30

The standard deviation	31
Other measures	32
Analysis of Large Data Sets	34
Frequency Distributions	35
Constructing a frequency distribution for continuous data	35
Constructing a frequency distribution for discrete data	38
Constructing a cumulative frequency distribution	40
Frequency distributions for nominal and ranked data	41
Other methods for displaying data	42
Summary Measures for Grouped Data	44
Finding the mean of a frequency distribution	45
Finding the median of a frequency distribution	46
Finding the mode of a frequency distribution	47
Finding the range of a frequency distribution	48
Finding the variance and standard deviation of a frequency distribution	48
Graphs of frequency distributions	49
Summary	52

3. PROBABILITY

Introduction	57
The Probability of an Event	58
Sample Space and Events	58
Three Sources of Probabilities	63
The classical approach	64
Odds	65
Long-run relative frequency	67
Odds and relative frequencies	68
Subjective approach to probabilities	69
The Mathematics of Probability	72
Computing the probability that two events will both occur: $P(A \text{ and } B)$	73
Computing the probability that at least one of two events will occur: $P(A \text{ or } B)$	75
Counting Techniques	80
Multiplication principle	81
Permutations and combinations	83
Comparison of permutations and combinations	87
Bayes's Rule	89
Summary	94

4. DISCONTINUOUS PROBABILITY DISTRIBUTIONS

Introduction	99
Random Variables	99
Expected value of a random variable	100
Sums of random variables	102

Probability Distributions	104
Discontinuous Distributions	107
The Binomial Distribution	107
The binomial formula	108
Binomial Tables	111
Individual binomial probabilities	111
Cumulative binomial table	111
Characteristics of binomial distributions	115
The Poisson Distribution	120
The Poisson formula	122
Application involving time	122
Application involving area	123
Poisson Tables	123
Individual Poisson probabilities	124
The cumulative Poisson table	124
The Poisson distribution as an approximation to the binomial	125
Other Discrete Distributions	128

5. CONTINUOUS PROBABILITY DISTRIBUTIONS

Introduction	135
The Uniform Distribution	137
Normal Distributions	139
Characteristics of normal distributions	140
The normal distribution as a model	142
The standard normal distribution	142
The standard normal table	145
The normal distribution as an approximation to the binomial	150
The Exponential Distribution	155
Summary	157

6. SAMPLING

Introduction	162
Samples and Populations	162
Sampling from a finite population	163
Sample versus census	164
Random Sampling	165
Obtaining a random sample	166
Random number tables	167
Other Sampling Designs	171
Probability versus nonprobability sampling	171
Judgment sampling	171
Probability sampling	172
Summary	174